Bowel Preparation for Colonoscopy

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ABSTRACT

Colonoscopy is the premier method for colonic evaluation and its diagnostic accuracy and therapeutic safety depends on the quality of the colonic cleansing. Bowel cleansing with polyethylene glycol and sodium phosphate provides cleansing with high-quality preparations with an acceptably low morbidity rate and a high degree of patient satisfaction in a cost-effective manner. Modifications have reduced the volume of the polyethylene glycol preparations. Sodium phosphate has been associated with electrolyte and osmolarity imbalances and nephrocalcinosis; therefore, its clinical use has been questioned. Polyethylene glycol may be safer in patients with a history of significant renal, heart, or liver disease.

KEYWORDS: Bowel preparation, sodium phosphate, polyethylene glycol, colonoscopy

Objectives: On completion of this article, the reader should be able to summarize the methods for mechanical bowel preparation for colonoscopy.

Colonoscopy is the premier method for colonic evaluation and its diagnostic accuracy and therapeutic safety depends on the quality of the colonic cleansing. The ideal mechanical bowel preparation would reliably empty the colon of all fecal material in a rapid fashion with no gross or histologic alteration of the colonic mucosa. It would also not cause any patient discomfort or shifts in fluids or electrolytes and would be inexpensive.^{1,2} Unfortunately, none of the preparations currently available meet all of these requirements.¹⁻⁴ All current preparations use a combination of cleansing methods such as dietary restrictions and osmotic or stimulative laxatives (Table 1). Important aspects of each method will be described.

CLEANSING METHODS

Dietary Restriction

One to 5 days on a clear liquid or low residue diet reduces the amount of stool. However, this method by

itself is insufficient to adequately cleanse the colon. Dietary restrictions are typically used the day prior to the planned procedure and clear liquids are used to maintain hydration following mechanical cleansing. Most regimes allow liquid oral intake up to 4 hours prior to sedation.

Osmotic Agents

Osmotic agents either retain water in the colon or pull water into the colon depending on their osmolality relative to tissue fluid. Common osmotic agents are nonabsorbed salts or metabolically inert compounds.

Polyethylene glycol electrolyte gastrointestinal lavage solution (PEG lavage) is an isosmotic solution composed of polyethylene glycol 3350 and an electrolyte solution (sodium 125 mmol/L, sulfate 40 mmol/L, chloride 35 mmol/L, bicarbonate 20 mmol/L, and potassium 10 mmol/L). This solution is available commercially as GoLytely[®] (Braintree Laboratories, Holbrook,

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Table 1 Colonoscopy Preparations

Class	Product	Mechanism of Action	Recommendations
<i>Sodium phosphate</i> Tablet	Visicol [®] (Salix Pharmaceuticals, Morrisville, NC)	Osmotic cathartic	20 tablets (3 tablets every 15 minutes) at 5 to 6 PM the evening before colonoscopy; repeat with 12 to 20 tablets 10 to 12 hours later (at least 3 hours before procedure)
	OsmoPrep [®] (Salix Pharmaceuticals, Morrisville, NC)		20 tablets (4 tablets every 15 minutes) at 5 to 6 PM the evening before colonoscopy; repeat with 12 tablets 10 to 12 hours later (at least 3 hours before procedure)
<i>Polyethylene glycol</i> 4-L PEG-ELS	GoLYtely [®] (Baintree Laboratories, Holbrook, MA)	Nonabsorbed osmotic agent	240 ml every 10 minutes beginning at 5 to 6 PM the evening before colonoscopy:
	Colyte [®] (Schwarz Pharma, Inc., Milwaukee, WI)		Single dosing (4L)
4-L SF-PEG	NuLYTELY [®] (Baintree Laboratories, Holbrook, MA)		Split dosing: (3 L that night), remaining 1 L 10 to 12 hours later (at least 3 hours before procedure)
	TriLyte [®] (Schwarz Pharma, Inc. Milwaukee, WI)		Same as above
2-L PEG-ELS and bisacodyl	HalfLyte [®] (Baintree Laboratories, Holbrook, MA)		2 bisacodyl tablets at noon the day before colonoscopy;
			240 mL every 10 minutes beginning at 5 to 6 PM (1 L); repeat 240 mL every 10 minutes beginning 3 to 4 hours before procedure (1 L)
2-L PEG and bisacodyl	MiraLAX [®] (Schering-Plough, Kenilworth, NJ)		Same as above
2-L PEG with ascorbate	MoviPrep [®] (Salix Pharmaceuticals, Morrisville, NC)		240 mL every 15 minutes beginning at 5 to 6 PM the evening before colonoscopy (1 L), followed by at least 16 oz of fluid; 240 ml every 15 minutes at least 3 hours before procedure (1 L) followed by at least 16 oz of fluid
	(Dulcolax [®] , Boehringer Ingelheim Pharmaceuticals, Ridgefield, CT)		2-4 (5 mg) tablets
<i>Stimulant laxative</i> Bisacodyl		Contact irritant (oral or rectal use)	

PEG, polyethylene glycol; PEG-ELS, polyethylene glycol with electrolytes; SF-PEG, sulfate free polyethylene glycol.

MA) and Colyte[®] (Schwarz Pharma, Inc., Milwaukee, WI). This preparation provides excellent cleansing (in 90 to 100% of patients), and is associated with no fluid or electrolyte problems. It has a mildly salty taste, is tolerated by patients, and multiple clinical trials have demonstrated its effectiveness.³⁻⁶ Although well tolerated, 5 to 15% of patients do not complete the preparation due to palatability or large volume.^{7,8}

The timing of PEG lavage administration appears to affect the quality of cleansing. Divided or split-dose regimens (a part of the prep is given the night before and the remainder the morning of the procedure) have shown better cleansing and toleration than administering all of the preparation the day before.³ However, this adds to scheduling challenges. Another study showed that consumption of PEG lavage less than 5 hours before the procedure resulted in better cleansing than when it was given more than 19 hours before the procedure.⁹ The addition of prokinetic agents (metoclopramide) or stimulants (bisacodyl) has not improved patient tolerance or cleansing with 4-L PEG lavage.³ PEG lavage is relatively safe for patients with electrolyte imbalance or fluid changes (renal failure, congestive heart failure, or liver disease with ascites) and is the method of choice for infants and children.³

This solution is now available in several flavors (e.g., pineapple, cherry) and as a slightly modified solution with no sodium sulfate for improved taste (NuLytely[®], Braintree Laboratories, TriLyte[®], Schwarz Pharma).¹⁰ Newer reduced volume options have been described to improve patient tolerance. Ten to twenty mg of bisacodyl are administered and followed in 4 to 6 hours with 2 liters of PEG lavage with electrolytes (Halfightly[®], Braintree Laboratories) or without electrolytes (Miralax[®], Braintree Laboratories) at doses of 240 mL (8 oz) every 10 minutes. Multiple studies comparing full-volume (4 L) to low-volume (2 L) PEG lavage preparations have demonstrated equal cleansing, but better tolerance with the low volumes.³

Another variation is a hypertonic PEG lavage solution with electrolytes and ascorbic acid (MoviPrep[®], Salix Pharmaceuticals, Morrisville, NC).¹¹ Two liters of the solution are administered in single or split dosage regimens followed by clear liquids.

Sodium phosphate is a hyperosmotic agent, which is available in liquid and tablet form. Aqueous sodium phosphate (Fleet[®], CB Fleet, Lynchburg, VA) is a low-volume preparation that draws water into the bowel lumen to promote cleansing. Significant fluid and electrolyte changes can occur.³ Sodium phosphate is diluted to prevent emesis and significant oral fluid is necessary to prevent dehydration. Some patients with compromised renal function, dehydration, hypercalcemia, or hypertension who use angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) have experienced phosphate nephropathy with the use of

sodium phosphate.¹² The renal impairment seems to be age and dose related and is not always reversible.³ This potential adverse effect with higher doses of sodium phosphate has led to the bowel preparation product being voluntarily withdrawn by the manufacturer as an over the counter product. It remains available as a prescription product but its future is uncertain. Dosing includes two doses of 30 to 45 mL of the oral solution at least 10 to 12 hours apart. Each dose is taken with at least 8 ounces of liquid followed by an additional 16 ounces of liquid. Sodium phosphate preparations have been also associated with aphthoid lesions in the colon. This may limit the usefulness of this preparation in patients undergoing colonoscopy for inflammatory bowel disease.

Tablet sodium phosphate preparations (sodium phosphate monobasic monohydrate with sodium phosphate dibasic anhydrate, Visicol[™], Incline Pharmaceutical, Blue Bell, PA) involve the ingestion of 32 to 40 tablets. Twenty tablets are ingested on the evening before the procedure and 12 to 20 tablets on the day of the procedure (3-5 hours before). The 20 tablets are taken as 4 tablets every 15 minutes with 8 ounces of clear liquids.^{13,14} A recent modification by the manufacturer (OsmoPrep[®], Salix Pharmaceuticals, Morrisville, NC) has reduced the size of the tablet. Bisacodyl has also been used as an adjunct by some physicians.

The Federal Drug Administration has included a Black Box warning with sodium phosphate products. This along with the need to consume a significant number of tablets has limited the adoption of this method. Over 16 studies of bowel preparations have shown that sodium phosphate produces bowel cleansing equivalent to PEG lavage with improved patient tolerance.¹⁵⁻¹⁸

Stimulate Agents

Cathartic or stimulate agents cause bowel wall contractions which produce evacuation. Regimens using these medications usually require 2 to 2 days to empty the colon of stool and are frequently combined with enemas and dietary restrictions. Cathartics have been associated with dehydration and electrolyte changes. In controlled trials using cathartics alone, adequate cleansing occurs in only 75 to 80% of patients.⁴

ADJUNCTIVE MEASURES

Enemas

Enemas (saline solution, soapsuds, tap water) work by dilution or irritation. They are messy and uncomfortable for patients and the nursing staff. They rarely provide adequate cleansing when used alone, but may be helpful in patients who present to endoscopy with inadequate cleansing.

SUMMARY

Several options are available to prepare patients for colonoscopy. Knowledge of the various options, along with their associated advantages and limitations, allows providers to choose the appropriate preparation for individual patients. As the quality of cleansing is roughly similar, the endoscopist's experience, patient preference and compliance seem to be major factors in the option selected. Each product manufacturer provides detailed instruction for their product. Current guidelines for colonoscopic bowel preparation have been produced by a task force from the American Society of Colon and Rectal Surgeons (ASCRS), the American Society for Gastrointestinal Endoscopy (AGE), and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES).³

Further research and studies will suggest preparations that will come closer to our ideals.

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